Part EC – The IECC, as Modified by Chapter Comm 63

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CHAPTER 4

RESIDENTIAL BUILDING DESIGN BY SYSTEMS ANALYSIS AND DESIGN OF BUILDINGS UTILIZING RENEWABLE ENERGY SOURCES

SECTION 401 SCOPE

401.1 General. This chapter establishes design criteria in terms of total energy use by a residential building, including all of its systems.

SECTION 402 SYSTEMS ANALYSIS

402.1 Energy analysis. Compliance with this chapter will require an analysis of the annual energy usage, hereinafter called an "annual energy analysis."

Note: The federal Department of Energy has developed RES*check*™, a computer program that may be used in demonstrating compliance for a residential building which has no more than 3 stories and has 3 or more dwelling units. The RES*check* program may be downloaded at http://www.energycodes.gov/. When using the program, the applicable code must be defined as the "2000 IECC." The use of the "Wisconsin" option will apply requirements associated with a 1 or 2 family dwelling, which are more restrictive than those associated with low-rise multifamily buildings.

Exception: Chapters 5 and 6 establishes criteria for different energy-consuming and enclosure elements of the building which, if followed, will eliminate the requirement for an annual energy analysis while meeting the intent of this code.

402.1.1 Standard design. A building designed in accordance with this chapter will be deemed as complying with this code if the calculated annual energy consumption is not greater than a similar building (defined as a "Standard design") whose enclosure elements and energy-consuming systems are designed in accordance with Chapter 5.

Exceptions:

1. The exterior wall assembly *U*-factors for the Standard design shall be selected by climate in accordance with Table 402.1.1(1).
2. The fenestration system *U*-factor used in the Standard design shall be selected by climate in accordance with Table 402.1.1(2).
3. The window area of the Standard design, inclusive of the framed sash and glazing area, shall be equal to 18 percent of the conditioned floor area of the Proposed design.
4. Skylights and other nonvertical roof glazing elements shall not be included in the Standard design, and ceiling *U*-factors used in the Standard design shall not include such elements in their computation.

402.1.2 Proposed design. For a proposed alternate building design (defined as a "Proposed design") to be considered similar to a "Standard design," it shall utilize the same energy source(s) for the same functions and have equal conditioned floor area and the same ratio of thermal envelope area to floor area (i.e., the same geometry), exterior design conditions, occupancy, climate data, and usage operational schedule as the Standard design.

TABLE 402.1.1(1)
STANDARD DESIGN WALL ASSEMBLY *U*-FACTORS (U_w)

HEATING DEGREE DAYS[a]	U_w (air to air)[b]
> 13,000	0.038
9,000-12,999	0.046
6,500-8,999	0.052
4,500-6,499	0.058
3,500-4,499	0.064
2,600-3,499	0.076
< 2,600	0.085

a. From Table 302.1.
b. Including framing effects.

TABLE 402.1.1(2)
STANDARD DESIGN FENESTRATION SYSTEM *U*-FACTORS (U_g or U_f)

HEATING DEGREE DAYS[a]	U_g FOR SECTION 502.2.1.1 AND U_f FOR SECTION 502.2.3.1 (air to air)[b]
> 13,000	0.25
9,000-12,999	0.26
6,500-8,999	0.28
4,500-6,499	0.30
3,500-4,499	0.41
2,600-3,499	0.44
700-2,599	0.47
< 700	0.74

a. From Table 302.1.
b. Entire assembly, including sash.

402.1.3 Input values for residential buildings. The input values in Sections 402.1.3.1 through 402.1.3.10 shall be used in calculating annual energy performance. The requirements of this section specifically indicate which variables shall remain constant between the Standard design and Proposed design calculations. The Standard design shall be a base version of the design that directly complies with the provisions of this code. The proposed building shall be permitted to utilize a design methodology that is demonstrated, through calculations satisfactory to the code offi-

cial, to have equal or lower annual energy use than the Standard design.

402.1.3.1 Glazing systems. The input values in Sections 402.1.3.1.1 through 402.1.3.1.5, specific to glazing systems, shall be used in calculating annual energy performance.

402.1.3.1.1 Orientation, Standard design. Equal areas on north, northeast, east, southeast, south, southwest, west, and northwest exposures shall be assumed.

402.1.3.1.2 Shading calculations, Proposed design. Results from shading calculations on a Proposed design shall not be used for groups of buildings, unless those results constitute the worst possible building orientation in terms of annual energy use, considering all eight of the above orientations for a group of otherwise identical Proposed designs.

402.1.3.1.3 Exterior shading, Standard design. Glazing areas in the Standard design shall not be provided with exterior shading such as roof overhangs. Energy performance impacts of added exterior shading for glazing areas which are accounted for in the Proposed design for a specific building shall be permitted, provided that the code official approves the actual installation of such systems.

402.1.3.1.4 Fenestration system solar heat gain coefficient, Standard design. The fenestration system solar heat gain coefficient (SHGC), inclusive of framed sash and glazing area, of the glazing systems in the Standard design shall be 0.40 for HDD < 3,500 and 0.68 for HDD ≥ 3,500 during periods of mechanical heating and cooling operation. These fenestration system SHGC values shall be multiplied together with (added in series to) the interior shading values as specified in Section 402.1.3.1.5 to arrive at an overall solar heat gain coefficient for the installed glazing system.

Where the SHGC characteristics of the proposed fenestration products are not known, the default SHGC values given in Table 102.5.2(3) shall be used for the Proposed design.

402.1.3.1.5 Interior shading, Standard design and Proposed design. The same schedule of interior shading values, expressed as the fraction of the solar heat gain admitted by the fenestration system that is also admitted by the interior shading, shall be assumed for the Standard and Proposed designs.

The values used for interior shading shall be 0.70 in summer, and 0.90 in winter.

Exception: South-facing solar gain apertures on passive heating Proposed designs analyzed using interior shading values for interior shading specific to those shading measures specified in the Proposed design, with values above used in the Standard design.

402.1.3.2 Passive solar. Passive solar building designs shall provide documentation, acceptable to the code official, that fixed external or other acceptable shading is provided to limit excessive summer cooling energy gains to the building interior.

402.1.3.3 Heat storage (thermal mass). The following input values, specific to heat storage (thermal mass), shall be used in calculating annual energy performance:

Internal mass	8 pounds per square foot (39 kg/m^2)
Structural mass	3.5 pounds per square foot (17 kg/m^2)

Passive solar buildings shall utilize at least 45 Btu/°F (7.92 kJ/K) of additional thermal mass, per square foot (m^2) of added glass area, when added south-facing glass area exceeds 33 percent of the total glass area in walls.

402.1.3.4 Building thermal envelope — surface areas and volume. The input values in Sections 402.1.3.4.1 through 402.1.3.4.4, specific to building thermal envelope surface areas, shall be used in calculating annual energy performance.

402.1.3.4.1 Floors, walls, ceiling. The Standard and Proposed designs shall have equal areas.

402.1.3.4.2 Foundation and floor type. The foundation and floor type for both the Standard and Proposed designs shall be equal.

402.1.3.4.3 Doors. The exterior door area of the Standard design shall have an equal exterior door area as that of the Proposed design with a U-factor of 0.2 Btu/h · ft^2 · °F [1.14 W/(m^2 · K)]. The U_d of the Standard design shall be selected to permit calculated U_o wall compliance of the Standard design.

402.1.3.4.4 Building volume. The volume of both the Standard and Proposed designs shall be equal.

402.1.3.5 Heating and cooling controls. Unless otherwise specified by local codes, heating and cooling thermostats shall be set to the default settings in Table 402.1.3.5 for the Standard and Proposed designs. The input values, specific to heating and cooling controls, shall be used in calculating annual energy performance.

TABLE 402.1.3.5
HEATING AND COOLING CONTROLS

PARAMETER	VALUE
Heating	68°F
Cooling	78°F
Set back/set up	5°F
Set-back/set-up duration	6 hours per day
Number of set-back/set-up periods per unit[a]	1
Maximum number of zones per unit[a]	2
Number of thermostats per zone	1

For SI: °C = [(°F)-32]/1.8.

a. Units = Number of living units in Standard and Proposed designs.

For materials with thermal resistivity values less than 4.0, the minimum insulation thickness shall be permitted to be increased in accordance with Equation 5-10.

$$\frac{4.0 \times \text{Table 503.3.3.1 Thickness}}{\text{Actual Resistivity}} = \text{New Minimum Thickness}$$

(Equation 5-10)

503.3.3.3 [Comm 63.0503 (2) (b)] Duct and plenum insulation. Duct and plenum insulation shall be provided in accordance with s. Comm 63.0803 (2) (f).

[M] 503.3.3.4 Duct construction. Ductwork shall be constructed and erected in accordance with the *International Mechanical Code.*

503.3.3.4.1 High- and medium-pressure duct systems. High-pressure and medium-pressure ducts shall be leak tested in accordance with the SMACNA *HVAC Air Duct Leakage Test Manual* with the rate of air leakage not to exceed the maximum rate specified in that standard.

503.3.3.4.2 [Comm 63.0503 (2) (c)] Low-pressure duct systems. Low-pressure duct systems shall comply with all of the following:

1. Sections of supply and return ducts not located entirely within the conditioned space, and the unconditioned side of enclosed stud bays or joist cavities or spaces that are used to transport air shall be sealed.
2. Sealing shall be accomplished using welds, gaskets, mastics, mastic-plus-embedded-fabric systems or tapes installed in accordance with the manufacturer's instructions.
3. Insulation that provides a continuous air barrier may be used in lieu of sealing metal ducts.
4. Tapes and mastics used with rigid fibrous glass ducts shall be listed and labeled as complying with UL 181A.
5. Tapes and mastics used with flexible air ducts shall be listed and labeled as complying with UL 181B.
6. Tapes with rubber-based adhesives may not be used.

Note: Standard duct tape has a rubber-based adhesive and does not comply with the requirements under this section.

Exception: Continuously welded and locking-type longitudinal joints and seams on ducts operating at static pressures less than 2 inches w.g. (500 Pa) pressure classification.

503.3.3.4.3 [Comm 63.0503 (2) (d)] Sealing required. High- and medium-pressure ducts shall be sealed in accordance with s. Comm 63.1029 (4).

503.3.3.5 [Comm 63.0503 (2) (e)] Mechanical ventilation. Each mechanical ventilation system (supply or exhaust, or both) shall be equipped with a readily accessible switch or other means for shutoff, or volume reduction and shutoff, when ventilation is not required. Automatic or gravity dampers that close when the system is not operating shall be provided for outdoor air exhausts. Motorized dampers that close when the system is not operating shall be provided on all outdoor air intakes.

503.3.3.6 Transport energy. The air-transport factor for each all-air system shall be not less than 5.5 when calculated in accordance with Equation 5-11. Energy for transfer of air through heat-recovery devices shall not be included in determining the air transport factor.

$$\text{Transport Factor} = \frac{\text{Space Sensible Heat Removal}^{a}}{\text{Supply Return Fan(s) Power Input}^{a}}$$

(Equation 5-11)

a. Expressed in consistent units, either Btu/h or watts.

For purposes of these calculations, space sensible heat removal is equivalent to the maximum coincident design sensible cooling load of all spaces served for which the system provides cooling. Fan power input is the rate of energy delivered to the fan prime mover.

Air and water, all-water and unitary systems employing chilled, hot, dual-temperature or condenser water-transport systems to space terminals shall not require greater transport energy (including central and terminal fan power and pump power) than an equivalent all-air system providing the same space sensible heat removal and having an air-transport factor of not less than 5.5.

503.3.3.7 [Comm 63.0503 (2) (f)] Balancing. Balancing and documentation of the HVAC system shall conform to the IMC.

SECTION 504
SERVICE WATER HEATING

504.1 Scope. The purpose of this section is to provide criteria for design and equipment selection that will produce energy savings when applied to service water heating. Water supplies to ice-making machines and refrigerators shall be taken from a cold-water line of the water distribution system.

504.2 Water heaters, storage tanks and boilers. Water heaters, storage tanks and boilers shall meet the performance criteria set forth in Sections 504.2.1 and 504.2.2.

504.2.1 Performance efficiency. Water heaters and hot water storage tanks shall meet the minimum performance of water-heating equipment specified in Table 504.2. Where multiple criteria are listed, all criteria shall be met.

Exception: Storage water heaters and hot water storage tanks having more than 140 gallons (530 L) of storage capacity need not meet the standby loss (*SL*) or heat loss (*HL*) requirements of Table 504.2 if the tank surface area is thermally insulated to R-12.5 and if a standing pilot light is not used.

504.2.2 Combination service water-heating/space-heating boilers. Service water-heating equipment shall not be

dependent on year-round operation of space-heating boilers; that is, boilers that have as another function winter space heating.

Exceptions:

1. Deleted.
2. For systems where the use of a single heating unit will lead to energy savings, such unit shall be utilized.

504.3 Deleted.

504.3.1 - 504.3.3 Deleted.

504.4 Pump operation. Circulating hot water systems shall be arranged so that the circulation pump(s) can be conveniently turned off, automatically or manually, when the hot water system is not in operation.

504.5 [Comm 63.504 (2)] Pipe insulation. Pipe insulation shall be provided in accordance with s. Comm 63.1029 (1) and (2).

504.6 Conservation of hot water. Hot water shall be conserved in accordance with Section 504.6.1.

504.6.1 Showers. Shower heads shall have a maximum flow rate of 2.5 gallons per minute (gpm) (0.158 L/s) at a pressure

TABLE 504.2
MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT

CATEGORY	TYPE	FUEL	INPUT RATING	V_T[a] (gallons)	INPUT TO V_T RATIO (Btuh/gal)	TEST METHOD	ENERGY FACTOR[b]	THERMAL EFFICIENCY E_t (percent)	STANDBY LOSS (percent/hour)[a]
NAECA-covered water-heating equipment[c]	All	Electric	≤ 12kW	All[e]	—	Note f	≥ 0.93-0.00132V*	—	—
	Storage	Gas	≤ 75,000 Btu/h	All[e]	—	Note f	≥ 0.62-0.0019V*	—	—
	Instantaneous	Gas	≤ 200,000Btu/h[e]	All	—	Note f	≥ 0.62-0.0019V*	—	—
	Storage	Oil	≤ 105,000 Btu/h	All	—	Note f	≥ 0.59-0.0019V*	—	—
	Instantaneous	Oil	≤ 210,000 Btu/h	All	—	Note f	≥ 0.59-0.0019V*	—	—
	Pool heater	Gas/oil	All	All	—	Note g	—	≥ 78%	—
Other water-heating equipment[d]	Storage	Electric	All	All	—	Note h	—	—	≤ 0.30+27/V_T*
	Storage/ instantaneous	Gas/oil	≤ 155,000 Btu/h	All	< 4,000	Note h	—	≥ 78%	≤ 1.3+114/V_T*
			> 155,000 Btu/h	All	< 4,000	Note h	—	≥ 78%	≤ 1.3+95/V_T*
				< 10	≥ 4,000	Note h	—	≥ 80%	—
				≥ 10	≥ 4,000			≥ 77%	≤ 2. 3+67/V_T*
Unfired storage tanks	—	—	—	All	—	—	—	—	≤ 6.5Btuh/ft^2[i]*

For SI: 1 Btu/ft^2 = 3.155 W/m^2, 1 Btu/h = 0.2931 W, 1 gallon = 3.785 L, °C = [(°F)-32]/1.8.

a. V_T is the storage volume in gallons as measured during the standby loss test. For the purpose of estimating the standby loss requirement using the rated volume shown on the rating plate, V_T should be no less than 0.95V for gas and oil water heaters and no less than 0.90V for electric water heaters.

b. V is rated storage volume in gallons as specified by the manufacturer.

c. Consistent with National Appliance Energy Conservation Act (NAECA) of 1987.

d. All except those water heaters covered by NAECA.

e. DOE CFR 10; Part 430, Subpart B, Appendix E applies to electric and gas storage water heaters with rated volumes 20 gallons and gas instantaneous water heaters with input ratings of 50,000 to 200,000 Btu/h.

f. DOE CFR 10; Part 430, Subpart B, Appendix E.

g. ANSI Z21.56.

h. ANSI Z21.10.3. When testing an electric storage water heater for standby loss using the test procedure of Section 2.9 of ANSI Z21.10.3, the electrical supply voltage shall be maintained within ± 1 percent of the center of the voltage range specified on the water heater nameplate. Also, when needed for calculations, the thermal efficiency (E_t) shall be 98 percent. When testing an oil water heater using the test procedures of Sections 2.8 and 2.9 of ANSI Z21.10.3, the following modifications will be made: A vertical length of the flue pipe shall be connected to the flue gas outlet of sufficient height to establish the minimum draft specified in the manufacturer's installation instructions. All measurements of oil consumption will be taken by instruments with an accuracy of ± 1 percent or better. The burner shall be adjusted to achieve an hourly Btu input rate within ± 2 percent of the manufacturer's specified input rate with the CO_2 reading as specified by the manufacturer with smoke no greater than 1 and the fuel pump pressure within ± 1percent of the manufacturer's specification.

i. Heat loss of tank surface area (Btu/h · ft^2) based on 80°F water-air temperature difference.

* Minimum efficiencies marked with an asterisk are established by preemptive federal law and are printed for the convenience of the user.

of 80 pounds per square inch (psi) (551 kPa) when tested in accordance with ASME A112.18.1.

TABLE 504.5
MINIMUM PIPE INSULATION
(thickness in inches)

SERVICE WATER-HEATING TEMPERATURES (°F)	PIPE SIZES[a]			
	Noncirculating runouts	Circulating mains and runouts		
	Up to 1″	Up to 1.25″	1.5″ to 2″	Over 2″
170-180	0.5	1.0	1.5	2.0
140-169	0.5	0.5	1.0	1.5
100-139	0.5	0.5	0.5	1.0

For SI: 1 inch = 25.4 mm, °C = [(°F)-32]/1.8,
1 Btu/h/inch · ft^2 · °F = 0.144 W/(m · K).

a. Nominal iron pipe size and insulation thickness. Conductivity, $k \cong 0.27$

504.7 Heat traps. Water heaters with vertical pipe risers shall have a heat trap on both the inlet and outlet of the water heater unless the water heater has an integral heat trap or is part of a circulating system.

SECTION 505
ELECTRICAL POWER AND LIGHTING

505.1 Electrical energy consumption. In Type A-2 residential buildings having individual dwelling units, provisions shall be made to determine the electrical energy consumed by each tenant by separately metering individual dwelling units.

505.2 [Comm 63.0505] Lighting power budget. Lighting systems shall comply with ss. Comm 63.1040 to 63.1053.

CHAPTER 9
REFERENCED STANDARDS

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 107.

AAMA

American Architectural Manufacturers Association
1827 Walden Office Square
Suite 104
Schaumburg, IL 60173-4628

Standard reference number	Title	Referenced in code section number
101/I.S.2—97	Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors	Table 502.1.4.1, 601.3.2.2, 802.3.1

ANSI

American National Standards Institute
25 West 43rd Street
Fourth Floor
New York, NY 10036

Standard reference number	Title	Referenced in code section number
Z21.10.3—98	Gas Water Heaters, Volume III, Circulating Tank, Instantaneous and Large Automatic Storage-Type Heaters	Table 504.2
Z21.13—91	Gas-Fired Low-Pressure Steam and Hot Water Boilers—with 1993 and 1994 Addenda	Table 803.2.2(5)
Z21.47—93	Gas-Fired Central Furnaces (Except Direct Vent and Separated Combustion System Furnaces) — with Addendum Z21.47a-1995 and Z21.47b-1997.	Table 803.2.2(4)
Z21.56—98	Gas-Fired Pool Heaters	Table 504.2
Z83.8—96	Gas-Fired Duct Furnaces—with Addendum Z83.8a-1997	Table 803.2.2(4), Table 803.3.2(3)
Z83.9—96	Gas Unit Heaters.	Table 803.2.2(4), Table 803.3.2(3)

ARI

Air Conditioning and Refrigeration Institute
4301 North Fairfax Drive
Suite 425
Arlington, VA 22203

Standard reference number	Title	Referenced in code section number
210/240—94	Unitary Air-Conditioning and Air-Source Heat Pump Equipment.	Table 503.2, Table 803.2.2(1), Table 803.2.2(2)
320—93	Water Source Heat Pumps	Table 803.2.2(2)
325—93	Ground Water Source Heat Pumps	Table 803.2.2(2)
340/360—93	Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.	Table 803.2.2(1), Table 803.2.2(2)
365—94	Commercial and Industrial Unitary Air-Conditioning Condensing Units	Table 803.3.2(1)
310/380—93	Standard for Packaged Terminal Air-Conditioners and Heat Pumps.	202, Table 803.2.2(3)
550/590—98	Water Chilling Packages Using the Vapor Compression Cycle	Table 803.3.2(2)

ASHRAE

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
1791 Tullie Circle, NE
Atlanta, GA 30329-2305

Standard reference number	Title	Referenced in code section number
55—92	Thermal Environmental Conditions for Human Occupancy	202
62—89	Ventilation for Acceptable Indoor Air Quality.	202
90.1—89	Energy Efficient Design of New Buildings, Except Low Rise Residential Buildings	63.1016 Note, 63.1020

ASHRAE—continued

136—93	A Method of Determining Air Change Rates in Detached Dwellings	402.1.3.10
ASHRAE/IESNA—93	Energy Code for Commercial and High-Rise Residential Buildings — Based on ASHRAE/IES 90.1-1989—with Revisions thru October 7, 1997 including Errata and Addendum 90.1c-1993	503.1, 801.2, 802.1, 802.2
ASHRAE—97	Handbook of Fundamentals	Table 302.1, 402.3.2, 502.2.1.1.2, 502.2.2, 503.3.1, 803.2.1
ASHRAE—87	HVAC Systems and Applications Handbook	504.2.2

ASME

American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Standard reference number	Title	Referenced in code section number
A112.18.1M—96	Plumbing Fixture Fittings	504.6.1

ASTM

ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428-2859

Standard reference number	Title	Referenced in code section number
C 236—93	Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box	602.1.1.1
C 177—85	Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-hot-plate Apparatus	63.1018(2)(a)
C 335—84	Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation	63.1018(2)(a)
C 518—98	Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus	Comm 63.1018(2)(a)2
C 976—96$^{\epsilon 1}$	Standard Test Method for Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box	602.1.1.1
D 4099—95	Standard Specification for Poly (Vinyl Chloride) PVC Prime Windows/Sliding Glass Doors	Table 502.1.4.1
E 96—95	Standard Test Methods for Water Vapor Transmission of Materials	502.1.1, 602.1.7, 802.1.2
E 283—91	Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen	502.1.3, Table 502.1.4.1, 802.3.1
E 779—92$^{\epsilon 1}$	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization	402.1.3.10

DOE

U.S. Department of Energy
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

Standard reference number	Title	Referenced in code section number
10 CFR; Part 430, Subpart B, Appendix E—98	Uniform Test Method for Measuring the Energy Consumption of Water Heaters	Table 504.2, Table 803.2.2(4)
10 CFR; Part 430, Subpart B, Appendix N—98	Uniform Test Method for Measuring the Energy Consumption of Furnaces	Table 503.2, Table 803.2.2(5)
10 CFR; Part 430, Subpart B, Test Procedures—98	Energy Conservation Program for Consumer Products	202
DOE —88	DOE Building Foundation Design Handbook	Table 502.2, 502.2.1.5, 502.2.3.5
DOE—Current Calendar Year	DOE State-Average Energy Prices	806.2.3

HI

Hydronics Institute
35 Russo Place
P.O. Box 218
Berkley Heights, NJ 07922

Standard reference number	Title	Referenced in code section number
HI HBS 86—89	Heating Boiler Standard 86 - Testing and Rating Standard for Heating Boilers, 6th Ed.	Table 803.2.2(5)